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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/822,414	04/02/2001	Hiroya Kirimura	P107351-00011	9442

7590 10/18/2004

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 10/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/822,414	KIRIMURA ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. In view of the Appeal Brief filed on 9/26/2003, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 16 is rejected under 35 U.S.C. 102(e) as being anticipated by Zhang et al (US 5,766,344).

Zhang et al discloses a method of forming a crystalline silicon film comprising a plasma chemical vapor deposition (CVD) apparatus, this reads on applicants' film forming device, provided with a high vacuum exhausting device and a window of quartz so that a laser can be irradiated from the outside, this reads on applicants' laser beam irradiating device (col 5, ln 60 to col 6, ln 20). Zhang et al also discloses a noncrystalline silicon hydride semiconductor layer **13**, this reads on applicants' pre-film, was formed by plasma CVD and crystallization of the sample was effected by an excimer laser irradiation (col 5, ln 5-61 and claim 1). Zhang et al also teaches the processes from the film forming to the laser irradiation may be effected in succession without a transfer of the sample instead of using a chamber exclusively used in the laser annealing (col 5, ln 60 to col 6, ln 10), this reads on applicants' producing the intended crystalline silicon film from the pre-film by irradiating the pre-film in the vacuum chamber subsequently to the formation of the pre-film.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out

the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) as applied to claim 16 above, and further in view of Fan et al (US 4,309,225).

Zhang et al discloses all of the limitations of claim 17, as discussed previously in claim 16, except operating the energy beam irradiation device to irradiate the formed pre-film with the energy beam while moving the substrate in a second direction crossing the first direction.

In a method of forming an amorphous material with a moving energy beam, Fan et al teaches how to provide continuous, controlled motion of a crystallization front in an amorphous material by controlling parameters such as the rate at which a laser beam or other beam of energy is moved across an amorphous material (col 2, ln 1-67). Fan et al also discloses scanning of a semiconductor can be achieved by mounting a sample chamber on translational stages **28**,**30** and **32** provide the capability to move the chamber and thus the semiconductor in the x, y, and z directions, this reads on applicant's moving the substrate in a second directions. Fan et al also discloses each stage can be driven separately or simultaneously and the rate at which each stage can be driven is variable (col 4, ln 25-67; col 5, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Zhang et al with Fan et al to obtain continuous, controlled motion of a crystallization front in an amorphous material.

6. Claims 17-19, 23, and 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) as applied to claim 16 above, and further in view of Asakawa et al (US 5,795,385).

Zhang et al discloses all of the limitations of claim 17, as discussed previously in claim 16, except operating the energy beam irradiation device to irradiate the formed pre-film with the energy beam while moving the substrate in a second direction crossing the first direction.

In a method of forming a single crystalline thin film by beam irradiation, Asakawa et al teaches an amorphous substrate using plasma chemical vapor deposition while simultaneously irradiating the substrate with beams of low energy gas (col 4, ln 30-67). Asakawa et al teaches the substrate can be scanned by a substrate moving means, whereby it is possible to from a single crystalline thin film having high homogeneity on a long substrate (col 10, ln 5-45; Eleventh Preferred Embodiment). Asakawa et al also teaches it is possible to facilitate formation of an amorphous thin film by intermittently applying beams from an ion source while regularly supplying a reaction gas and rotating the substrate during application pauses (col 12, ln 1-50). Asakawa et al also teaches neon ions can be accelerated to 200-600 eV by an ion source **83** (col 23, ln 20-55). Asakawa et al also teaches a plasma CVD process (col 32, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Zhang et al with Asakawa et al to form a thin film having high homogeneity on a long substrate.

Referring to claim 19, the combination of Zhang et al and Asakawa et al teaches a pre-film of the crystalline silicon film is formed on the target surface while emitting an ion beam to the substrate in the step of form the pre-film by the film forming device ('385 col 4, ln 50-67).

Referring to claim 23, the combination of Zhang et al and Asakawa et al teaches formation of an amorphous film by intermittently applying beams from an ion source while supplying reaction gas, this reads on applicant's ion beam is emitted to the target surface of the substrate in an initial stage of the forming of the pre-film.

Referring to claim 31-32, the combination of Zhang et al and Asakawa et al teaches plasma CVD using silane and hydrogen ('344 col 5, ln 30-35).

7. Claim 21, 23-25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) in view of Asakawa et al (US 5,795,385) or Zhang et al (US 5,766,344) in view of Fan et al (US 4,309,225) applied to claims 17 above, and further in view of Selvakumar et al (US 5,633,194).

The combination of Zhang et al and Asakawa et al or the combination of Zhang et al and Fan et al teaches all of the limitations of claim 21, as discussed previously in claim 17, an ion beam is emitted to the target surface of the substrate from the ion source prior to the step of forming the pre-film

In a method of forming epitaxial grown Si utilizing ion beams (col 1, ln 35-65), Selvakumar et al teaches in-situ cleaning of a substrate surface by argon ion bombardment prior to the start of deposition, where a 200 eV argon ion beam was used to sputter clean the substrate in a necessary step which significantly influences the quality of a grown film by removing native oxide. Selvakumar et al also discloses an inexpensive ion beam vapor deposition technique used to grow silicon films, where an ion source **13** was used to ionize a gas to accelerate an ion beam towards a substrate with a current between 30-1000 eV using high purity argon and silane gases

as sources for the ion beam (col 6, ln 20-65; col 7, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Zhang et al and Asakawa et al or the combination of Zhang et al and Fan et al with Selvakumar et al to clean the substrate.

Referring to claim 30, Overlapping ranges are held to be obvious (MPEP 2144.05).

8. Claims 20, 22, and 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) as applied to claim 16 above, and further in view of Selvakumar et al (US 5,633,194).

Zhang et al discloses all of the limitations of claim 20, as discussed previously in claim 16, except an ion beam is emitted to the target surface of the substrate from the ion source prior to the step of forming the pre-film.

In a method of forming epitaxial grown Si utilizing ion beams (col 1, ln 35-65), Selvakumar et al teaches in-situ cleaning of a substrate surface by argon ion bombardment prior to the start of deposition, where a 200 eV argon ion beam was used to sputter clean the substrate in a necessary step which significantly influences the quality of a grown film by removing native oxide. Selvakumar et al also discloses an inexpensive ion beam vapor deposition technique used to grow silicon films, where an ion source **13** was used to ionize a gas to accelerate an ion beam towards a substrate with a current between 30-1000 eV using high purity argon and silane gases as sources for the ion beam (col 6, ln 20-65; col 7, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Zhang et al with Selvakumar et al to clean the substrate.

Referring to claim 26-29, the combination of Zhang et al and Selvakumar et al teaches an ion beam where a current can be adjusted between 30-1000 eV and a cleaning at 200 eV. Overlapping ranges are held to be obvious (MPEP 2144.05).

9. Claims 20, 22, 24, and 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) as applied to claim 16 above, and further in view of Ichikawa et al (US 5,484,746).

Zhang et al teaches all of the limitations of claim 20, as discussed previously in claim 16, except an ion beam is emitted to the target surface of the substrate from the ion source prior to the step of forming the pre-film.

In a process of forming a semiconductor thin film, Ichikawa et al teaches cleaning surface adherents is performed by use of ions controlled in magnitude of energy (i.e. claim 20) and it is desirable that the surface cleaning step and the later deposition step of an amorphous semiconductor layer should be performed continuously so that no contaminant may be adsorbed. Ichikawa et al also teaches removing surface adherents with ions has been realized within sputtering apparatus in the form of cleaning of a silicon surface with argon ions, this reads on applicant's ion beam is emitted to the target surface prior to the step of forming the pre-film, and by performing sputtering film formation in the same apparatus immediately after the cleaning step, thin films exhibiting various crystallinity from single crystal silicon to amorphous silicon which are dependent on the irradiation energy to the substrate can be deposited on the silicon substrate (col 3, ln 1-67). Ichikawa et al also teaches sputtering a target is caused to occur by irradiations of argon (i.e. claim 18) and a power source **109** for supplying energy in the cleaning

step (col 4, ln 1-67). Ichikawa et al also teaches sputter cleaning of a semiconductor with argon has been also used as the pre-treatment of low temperature silicon epitaxial growth by CVD with argon ions generally more than 100 eV are used at a lowered processing temperature (col 1, ln 20-67; col 2, ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Zhang et al with Ichikawa et al to remove surface adherents from a substrate

Referring to claim 22, the combination of Zhang et al and Ichikawa et al teaches an ion source in an initial stage of the step of forming the pre-film by the film forming device (col 3, ln 10-35).

Referring to claim 24, the combination of Zhang et al and Ichikawa et al teaches cleaning with an ion beam and sputtering with an ion beam continuously, this reads on applicant's ion beam is emitted to the target surface of the substrate during a period from a stage before the pre-film forming step and forming device to an initial stage of the pre-film forming step.

Referring to claim 26-29, Overlapping ranges are held to be obvious (MPEP 2144.05).

10. Claims 21, 23, 25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344) in view of Fan et al (US 4,309,225) as applied to claim 17 above, and further in view of Ichikawa et al (US 5,484,746).

The combination of Zhang et al and Fan et al teach all of the limitations of claim 21, as discussed previously in claim 17, except emitting an ion beam to a target surface of a substrate prior to the step of forming the pre-film by the film forming device.

In a process of forming a semiconductor thin film, Ichikawa et al teaches cleaning surface adherents is performed by use of ions controlled in magnitude of energy (i.e. claim 20) and it is desirable that the surface cleaning step and the later deposition step of an amorphous semiconductor layer should be performed continuously so that no contaminant may be adsorbed. Ichikawa et al also teaches removing surface adherents with ions has been realized within sputtering apparatus in the form of cleaning of a silicon surface with argon ions, this reads on applicant's ion beam is emitted to the target surface prior to the step of forming the pre-film, and by performing sputtering film formation in the same apparatus immediately after the cleaning step, thin films exhibiting various crystallinity from single crystal silicon to amorphous silicon which are dependent on the irradiation energy to the substrate can be deposited on the silicon substrate (col 3, ln 1-67). Ichikawa et al also teaches sputtering a target is caused to occur by irradiations of argon (i.e. claim 18) and a power source **109** for supplying energy in the cleaning step (col 4, ln 1-67). Ichikawa et al also teaches sputter cleaning of a semiconductor with argon has been also used as the pre-treatment of low temperature silicon epitaxial growth by CVD with argon ions generally more than 100 eV are used at a lowered processing temperature (col 1, ln 20-67; col 2, ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Zhang et al and Fan et al with Ichikawa et al to remove surface adherents from a substrate

Referring to claim 23, the combination of Zhang et al, Fan et al and Ichikawa et al teaches an ion source in an initial stage of the step of forming the pre-film by the film forming device (' 746 col 3, ln 10-35).

Referring to claim 25, the combination of Zhang et al, Fan et al and Ichikawa et al teaches cleaning with an ion beam and sputtering with an ion beam continuously, this reads on applicant's ion beam is emitted to the target surface of the substrate during a period from a stage before the pre-film forming step and forming device to an initial stage of the pre-film forming step.

Referring to claim 30, Overlapping ranges are held to be obvious (MPEP 2144.05).

11. Claims 22 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (US 5,766,344), as applied to claim 16 above, and further in view of Krimmel (US 4,140,546).

Zhang et al teach all of the limitations of claim 22, as discussed previously in claim 16, except an ion beam is emitted to the target surface of the substrate from an ion source in an initial stage of the step of forming the pre-film by the film forming device.

In a method of producing a monocrystalline layer of a substrate (col 1-8), Krimmel teaches an electron beam vaporizer means may be utilized to produce a vapor flux of a material being deposited and to produce an ion flux which contains ions composed of a material being vapor deposited (col 4, ln 20-50). Krimmel also teaches a silicon substrate **6**, vaporizing material, which is deposited on the substrate and simultaneously ions are accelerated to the surface of the substrate, this reads on applicant's initial stage of forming the pre-film (col 5, ln 10-55). Krimmel also teaches an ion flux having an energy of 10 keV (claim 1). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Zhang et al

with Krimmel's ion beam to increase adhesive strength and increase a corrosion barrier for the material grown (col 3, ln 25-40).

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER